



USAID
FROM THE AMERICAN PEOPLE

K4HealthTM

Knowledge for Health

Summary Report of the K4Health Environment Scan: Findings and Implications



Knowledge for Health (K4Health)

www.k4health.org

Leader with Associate Cooperative Agreement Award

GPO-A-OO-08-00006-00

October 2009



JOHNS HOPKINS
BLOOMBERG
SCHOOL of PUBLIC HEALTH

Center for Communication Programs



Family Health
International



Management Sciences for Health

Acknowledgments

The K4Health Environment Scan was conducted and written by Adrienne Kols. We would like to thank all of the staff members at HIPNET member organizations who volunteered to be interviewed. Their insights have contributed greatly to the report.

Table of Contents	Page
Introduction	1
Health Information Needs	1
<i>Barriers to access</i>	1
<i>Commonly used resources</i>	2
<i>Creating useful information</i>	2
Access to the Internet	3
<i>The digital divide</i>	3
<i>Barriers to access</i>	5
<i>Strategies to expand Internet access</i>	7
Promising Technologies and Tools	8
<i>Mobile devices</i>	8
<i>Multimedia</i>	10
<i>Web 2.0</i>	11
ICT Applications for Health	13
<i>Professional development</i>	14
<i>Support for patient care</i>	15
<i>Networking</i>	15
<i>Access to the literature</i>	16
Implications and Recommendations	17
<i>Appropriate technologies and tools</i>	17
<i>Meeting the need for locally relevant content</i>	17
<i>Needs assessments, monitoring, and evaluation</i>	18
References	19

Introduction

The Knowledge for Health (K4Health) project seeks to improve family planning and reproductive health (FP/RH) and other health services in international public health settings using proven knowledge management approaches. K4Health commissioned an Environment Scan in 2009 to explore future directions for health information programs. The Scan was guided by the following research questions:

1. What health information needs assessments have been conducted with health care program managers and service providers in international public health settings? What are the key findings?
2. What is access to the Internet like in low- and middle-income countries? What issues are there for developing Web sites and other online knowledge exchange mechanisms?
3. What are the most promising technologies and tools for reaching program managers and service providers? What channels do organizations use to connect with staff and clients in the field?
4. What health knowledge networks serve FP/RH audiences? Which networks should K4Health collaborate with?
5. Who are the key stakeholders in FP/RH information?

To answer these questions, information was collected from three sources. Relevant publications were identified with the PubMed and POPLINE search engines and by searching online databases and bibliographies. Google and pertinent listservs were used to locate online resources, including grey literature, relevant projects, and health information networks. Telephone interviews were conducted with knowledge managers at 17 organizations that participated in meetings of the Health Information and Publications Network (HIPNET) during 2008 and 2009.

Health Information Needs

Health information needs assessments of providers and managers in low- and middle-income countries are limited in number and scope. Interviews with HIPNET members suggest that health information programs often rely on informal feedback to determine the information needs of their audiences; when they do conduct formal assessments, the results are generally not published.

Barriers to access

It is clear that access to useful health information remains limited in the developing world (Geyoushi et al., 2003; Hoppenbrouwer and Kanyengo, 2007; Kapiriri and Bondy, 2006; Muula et al., 2003, Pakenham-Walsh and Bukachi, 2009; Pandita and Singh, 2008). Health facilities and medical libraries often have few materials on hand, and these are frequently out of date or too sophisticated, too generic, or too theoretical to meet the practical needs of frontline providers. Slow, unreliable Internet connections and the high cost of books, journal subscriptions, and Internet access compound the problem.

However, just making information sources—including the Internet—readily available may not entirely solve the problem. Providers complain of long hours and heavy workloads that leave them with too little time to read updates or search for needed information. In the absence of a reading culture, health professionals may not even try to keep current unless there is a continuing medical education (CME) requirement or other incentive (Hoppenbrouwer & Kanyengo, 2007). Access to too much information, known as “information overload,” creates its own set of problems. For example, providers routinely complain that it is too difficult and too time-consuming to search through all of the material available on the Internet to find what they need.

Commonly used resources

When health professionals look for answers, they turn to the resources that require the least amount of time, effort, and money to consult. That means they largely rely on the following sources of information (Geyoushi et al., 2003; Hoppenbrouwer and Kanyengo, 2007; Kafiriri and Bondy, 2006; Masters, 2008; Muula et al., 2003; Smith et al., 2007):

- Activities sponsored by the facility or the health care system, such as hospital or clinic meetings, seminars, training workshops, and CME programs;
- Official materials, such as guidelines, manuals, and hospital protocols;
- Discussions with colleagues; and
- Textbooks.

Where Internet access is available (see below), health professionals also look for information online, although they may not be aware of all of the resources available (Masters, 2008; Smith et al., 2007).

Creating useful information

Program managers and providers need information that is (Pakenham-Walsh and Bukachi, 2009; Revere et al., 2007):

- Trustworthy, that is, generated or verified by an authoritative source;
- Up-to-date and known to be regularly updated;
- Relevant to the local context;
- Practical rather than theoretical;
- Easy to digest; and
- Convenient and accessible.

To meet these goals, health information programs need to assess both the perceived and actual information needs of health workers, i.e., the information they say they want as well as the information they need to correct misconceptions and incorrect practices (Pakenham-Walsh & Bukachi, 2009). Programs must also be prepared to repackage information so that it is relevant, easy to digest and use, has a local focus, and is tailored to the needs of a specific audience, be it community health workers, midwives, program managers, or policy makers (Chetley, 2006; Godlee et al., 2004; Ladd et al., 2008; Pakenham-Walsh and Bukachi, 2009; Pandita and Singh, 2008; Revere et al., 2007; Roberts et al., 2007).

Language is also a central issue, but translating materials into local languages can be difficult and costly. Health information programs should consider reaching out to local information specialists for help repackaging information. While librarians and library services in the health sector are often overlooked and underused, they possess relevant knowledge and skills (Hoppenbrouwer and Kanyengo, 2007). Where information specialists do not exist, local staff can be trained as knowledge managers to filter, select, and adapt relevant content for health workers (Ladd et al., 2008).

Responding to local information needs in Kenya: AfriAya

AfriAya generates the HIV/AIDS content it distributes from a host of sources, including official Ministry of Health (MOH) publications, partner agencies, local HIV/AIDS organizations, and the Internet. However, it also looks to the communities it serves for inspiration by collecting community questions and concerns to ensure that it supplies the information that people want and that frontline providers need. Information specialists at a central hub are responsible for assembling and preparing the content. AfriAya quickly discovered that despite the large amount of information regarding HIV/AIDS on the Internet, very little was directly suitable for low-income communities. Therefore, AfriAya's information specialists must repackage the information to ensure that it is relevant and appropriate before sending it to AfriAya's field centers.

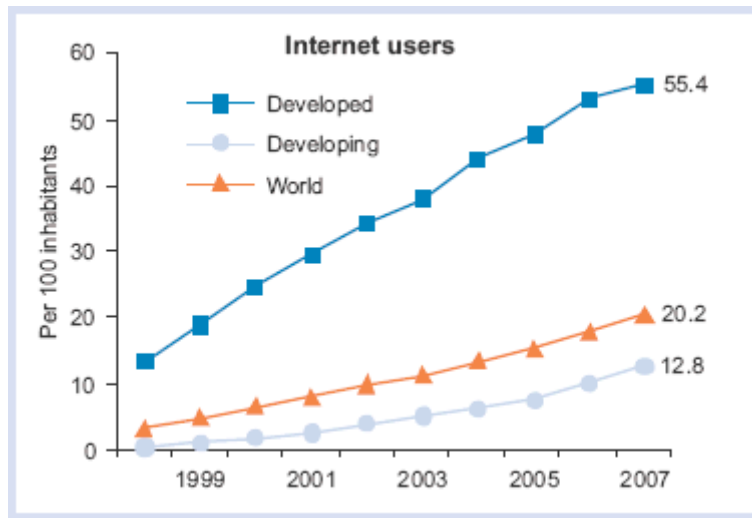
Source: Chetley, 2006

Access to the Internet

The digital divide

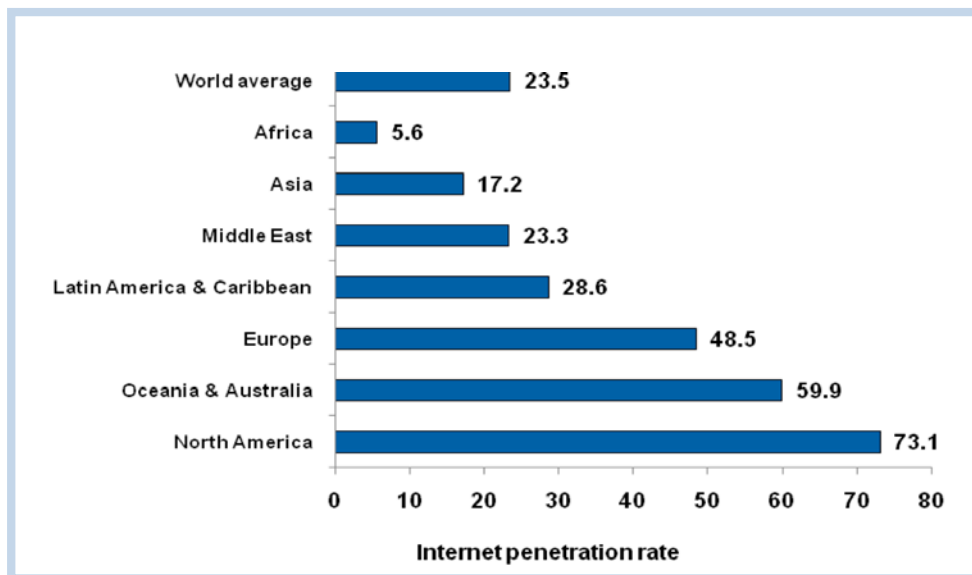
Internet use has grown rapidly over the past decade, but at a more rapid pace in developed than developing countries (see Figure 1). In 2008 almost one-quarter of the world's population used the Internet, but usage levels vary widely between and within regions (see Figure 2). Internet penetration is lowest in Africa, at 6%. It ranges from 17% to 29% in Asia, Latin America, and the Middle East. It peaks at 73% in North America (Internet World Stats, 2009). This gap will likely persist for many years to come because Internet penetration in low-income countries is converging very slowly with the rest of the world (Juech, 2008).

Figure 1. How many people are online?



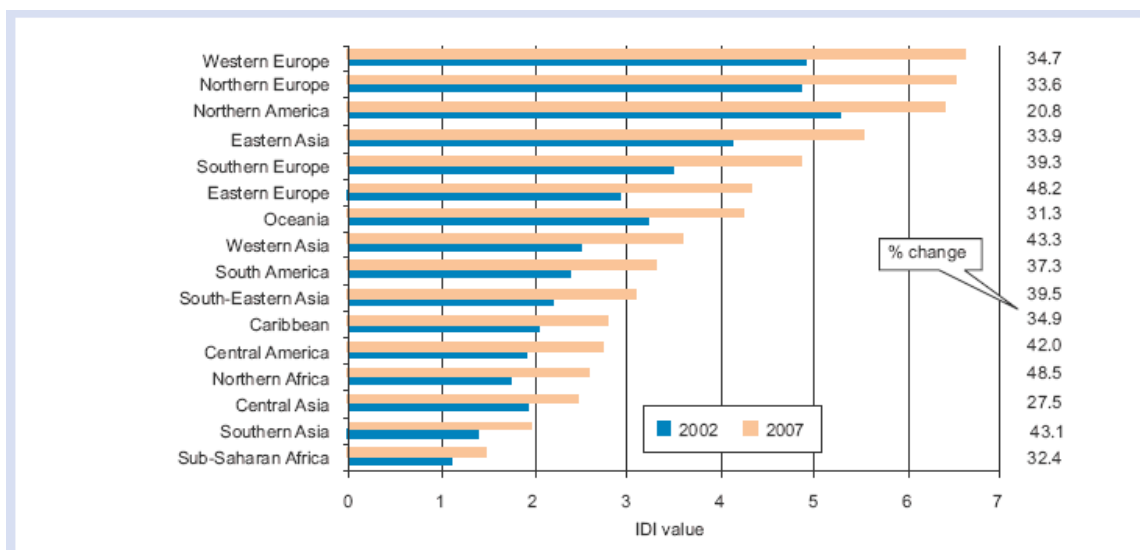
Source: ITU, 2009, p. 5

Figure 2. World Internet penetration in 2008



Source: Internet World Stats

The International Telecommunication Union (ITU) has created a broad measure of the digital divide between North and South. Its ICT Development Index (IDI) combines measures of ICT access (including phone lines, bandwidth, and home computers), ICT use (including Internet use and mobile broadband subscribers), and ICT skills (including literacy and school enrollment). As Figure 3 shows, the IDI increased in every region of the world from 2002 to 2007, but the digital divide barely changed. Developing countries remained almost as far behind in 2007 as they did in 2002 (ITU, 2009).

Figure 3. ICT Development Index (IDI) by geographic region, 2002-2007

Source: ITU, 2009, p. 23

The digital divide within low- and middle-income countries looms as large as the digital divide between North and South. For the most part, only urban and wealthy elites have access to new technologies in many countries because of cost and educational barriers (Chandrasekhar & Ghosh, 2001). For health care, this means that outside of tertiary centers, such as teaching hospitals and research institutions, only a very small percentage of health professionals have fast, reliable Internet connections. For example, a 2005 survey of primary care services in Brazilian municipalities with over 100,000 residents found that one in three primary care centers had a computer, but only one in ten had Internet access (Tomasi et al., 2009). Email is the most common use of the Internet for health professionals in sub-Saharan Africa and probably for those in Asia and Latin America as well. They use email for professional interactions, clinical advice, and referrals.

Despite the slow growth in fast Internet connections in low- and middle-income countries, health information programs are increasingly relying on the Web to disseminate materials. In areas where Internet connections are not available, they may fall back on CD-ROMs to disseminate materials because they have the capacity to hold large libraries of information or entire interactive training courses.

Barriers to access

Even when Internet connections are present in low- and middle-income countries, they tend to be unstable, slow, and costly, and program managers and providers are not always equipped to take full advantage of them. Common barriers to access include:

- **Poor infrastructure:** Some countries, especially in rural areas, often lack the basic prerequisites for fast and reliable Internet connections, including a stable power supply system, reliable telephone connections, sufficient server capacity, and an adequate number of Internet Service Providers (ISPs) (Chetley, 2006; Esteve & Machin, 2007; Oyodoke et al., 2005-06). Some countries also have poorer connections to the network of international fiber optic cables or Internet “trunks” (Maxfield, 2004). As a result, Internet bandwidth is far higher in developed economies (4,755 bits per inhabitant) than in transition economies (223 bits), developing economies (177 bits), or the least developed economies (7 bits) (Roberts, 2008).

Overcoming language barriers

Internet use in many regions of India is inhibited by the lack of content in the country’s 15 national languages. In response, N-Logue—whose franchisees provide telephone and Internet access at village kiosks—has established strategic alliances to create local language software and content in areas of interest, including education, agriculture, and financial products (Casparly and O'Connor, 2003).

Regional web portals have also been established to allow health professionals to access information and training in languages they understand. Examples include Sehetna (www.sehetna.com), the first Arabic-language health web portal, and the EurasiaHealth Knowledge Network (<http://www.eurasiahealth.org/aids>), which posts clinical practice guidelines, medical textbooks, and other educational materials on AIDS and tuberculosis in Russian and other languages spoken in the New Independent States (NIS) and Central and Eastern Europe (CEE).

- **High costs:** The cost of hardware, software, telephone connections, and ISPs is high in low- and middle-income countries, both in absolute terms and relative to the income people have available (Bukachi & Pakenham-Walsh, 2007; Juech, 2008). The rate at which hardware and software become obsolete exacerbates the financial burden. It is difficult for governments, NGOs, and cybercafé entrepreneurs to keep up with the latest equipment, which means that if health Web sites incorporate new generations of Internet applications, some users may not be able to access them (Maxfield, 2004).
- **Limited human capacity:** Health care staff at all levels—but especially those working at the primary and district levels—lack computer skills and experience and have rarely received any training in this area (Bukachi and Pakenham-Walsh, 2007; Pandita and Singh, 2008). They may also resist using ICTs because of the many changes these technologies bring to the way care is delivered, to work practices, and to who makes decisions about patient care (Chetley 2006). In addition, information technology (IT) professionals who can maintain computer systems and troubleshoot problems are in short supply in some countries outside of capital cities (Maxfield, 2004).

- **Language and literacy:** English remains the predominant language on the Web (Juech, 2008; Maxfield, 2004). Although an increasing number of health Web sites are being developed in French, Spanish, and Portuguese, much less is available in local languages such as Kiswahili and Hindi (Maxfield, 2004). In addition, most health Web sites, regardless of language, present material at a high school or college level of literacy; this may be beyond the understanding of frontline health workers (Elder and Clarke, 2009). Users may also lack the “Internet savvy” needed to distinguish authoritative and credible sources on the web (Maxfield, 2004).
- **Inappropriate content:** Global information packaged in the North dominates health content on the Web. There is a lack of locally created and locally relevant health information on the Internet, or even information that has been repackaged and contextualized to suit different locations (Chetley, 2006; Juech, 2008).

Strategies to expand Internet access

The rise of community access points (CAPs) is fueling much of the increase in Internet access in low- and middle-income countries. Rather than own their own computers, individuals access the Internet at for-profit urban cybercafés and rural Internet kiosks; government-subsidized telecenters; and libraries, schools, training centers, and community centers that serve learners (Colle, 2003).

Experience shows that health professionals in developing countries are willing to patronize cybercafés and other CAPs to access the Internet—even at some inconvenience to themselves (Lambat, 2008). If they have to pay for access, however, they may not be able to afford to stay online long enough to do extended Web browsing, and may be limited to email (Smith et al., 2007). Reliance on CAPs can also create other challenges for information dissemination. For example, cybercafé customers may not be able to install the applications needed to use CD-ROMs distributed by global information providers or to download and save files.

Community intermediaries offer another promising approach to expanding Internet access; they can be especially helpful in overcoming language and literacy barriers. Intermediaries search for useful information online on behalf of community members who lack access to or are unable to navigate the Internet. They translate the information they find into the local language, reframe it and put it into the local context, and disseminate it via local communication systems (Edejer, 2000). Individuals, such as teachers and agricultural extension workers, can serve as intermediaries, but organizations may offer greater potential for health programs. For example, health and development NGOs can download materials from the Web and distribute them to health workers in print, on CD-ROMs, or on flash drives.

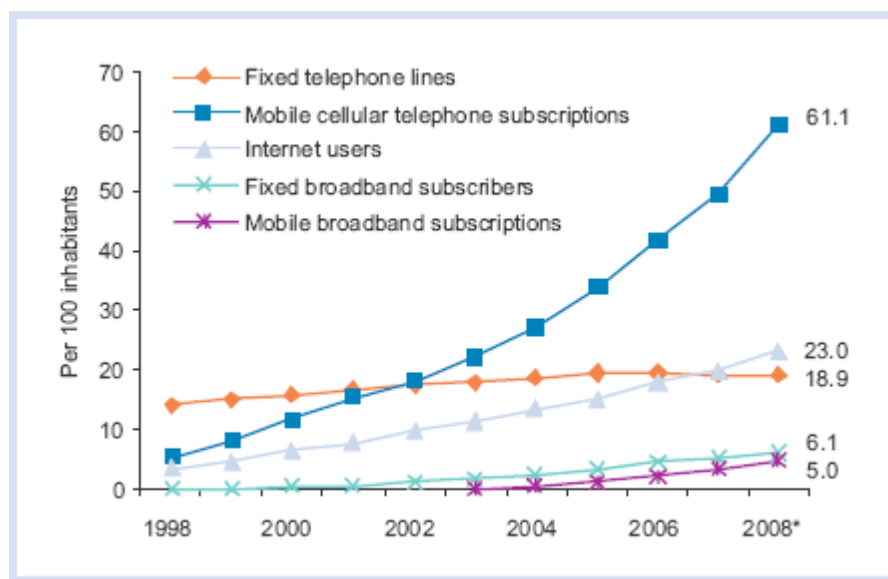
Community radio stations are emerging as one of the newest and most promising Internet intermediaries, because radio is the most pervasive, accessible, affordable, and flexible medium in rural areas. It also has a long tradition of serving as a community hub (Girard, 2003). In Sri Lanka, Kothmale Community Radio (KCR) primarily uses its computers and Internet access for research and production purposes, but it also broadcasts a program in which presenters browse the Internet on behalf of listeners who phone or mail in requests. Local experts, including doctors and lawyers, are invited to interpret the information for listeners; thus the radio station adds value to the information by putting it into local context. KCR also packages the most frequently requested information for off-line use (Casparry & O'Connor, 2003).

Promising Technologies and Tools

Mobile devices

Low- and middle-income countries are giving up on traditional wired telecommunications systems in favor of wireless networks, because they are cheaper to install, less dependent on existing infrastructures, and offer state-of-the-art technologies (Bukachi & Pakenham-Walsh, 2007). As a result, mobile phones are far more ubiquitous in many countries than other ICTs. For example, 90% of all telephone subscribers in Africa used mobile phones in 2007 (ITU, 2008). Mobile phones are also poised to take the lead over landlines for Internet access worldwide (see Figure 4), although the introduction of new technologies that permit fast wireless Internet connections is lagging in some countries (Esteve & Machin, 2007).

Figure 4. Growth in global ICTs, 1998-2008



Source: ITU, 2009, p. 3

Dozens of pilot projects and feasibility studies have explored the use of mobile technologies and wireless communication for health applications, although they have not yet collected convincing data on the impact, outcomes, or cost-effectiveness of the interventions (Kaplan, 2006). The SMS capability—also known as text messaging—of basic mobile phones is appealing because it is far less expensive and more robust than voice, does not require high bandwidth, can reach people even when they have their phones turned off, and can be sent simultaneously to many people (Kaplan, 2006; West, 2008). Although applications are limited by the brevity of the messages allowed (160 characters), SMS messaging has been successfully used for a wide range of health activities. For example, the FrontlineSMS text messaging system, which allows a computer to send and receive group text messages, has been successfully deployed in dozens of international public health settings. Among many other applications, it has been used to send health alerts and patient reminders, coordinate healthcare workers and programs, run surveys, and provide HIV/AIDS information (United Nations, 2007; Vital Waves Consulting, 2009).

Voice communication is the traditional domain of telephones and, unlike SMS, it does not require literacy. New technologies that can recognize or synthesize natural speech offer the potential to affordably scale up voice-based solutions. The agricultural sector has pioneered voice-based information systems that let farmers in Africa and India use mobile phones to call in for recorded messages concerning crops and livestock phones (British Telecommunications, 2007; Gakuru et al., 2009). While voice systems may not offer as much detail as the visual interfaces offered by print materials and the Web, the voice solution is still a promising platform for less literate health workers in some countries. For instance, it can be customized for local languages, is readily accessible, and is a very natural way of seeking information (Gakuru et al., 2009). Currently, there are a number of projects field testing voice information systems, including one focused on community health workers in Pakistan (see box below).

The Satellife project has tested the usefulness of a different mobile device, the personal digital assistant (PDA), for nurses and doctors in a dozen developing countries (Bridges, 2003; Satellife, 2005). Providers praised the convenience of the PDAs, which came preloaded with a virtual library of reference materials and job aids, and incorporated them into their daily routines. The project concluded that ease of updating the materials offset the need to reformat them to fit the small screen of a PDA. However, the cost of the devices, the need for a reliable power supply, and the required technical support all pose challenges to scaling up the approach.

Phoning for health information in Pakistan: HealthLine

Microsoft and others are developing a speech recognition-based information system to ensure that semi-literate community health workers have access to critical information. HealthLine's menu-driven program can be accessed via landlines or mobile phones. Callers specify a topic or disease and are walked through a set of menus until they reach the information they are seeking, which comes in the form of a prerecorded message in their local language. Providers can use it for immediate help in treating a patient or for self-learning. Field testing began with low-literate maternal and child health (MCH) community health workers in Pakistan in 2007, and the system has been refined in response (Sherwani, 2007; Vital Wave Consulting, 2009). User studies found that it was important to employ the local language, Sindhi, rather than Pakistan's lingua franca, Urdu; that health workers prefer using a spoken menu rather than the telephone keypad to select menu choices; and that the least literate users still find it difficult to use the system. An expansion to East Africa is now being planned (<http://www.cs.cmu.edu/~healthline/>).

People in low- and middle-income countries are increasingly using wireless devices, including smartphones and PDAs, to connect to the Internet because they are more widely available and less expensive and technically demanding than computers (Elder and Clarke, 2009). It is possible that mobile devices, rather than computers, will eventually become the primary way that Africans and Asians access the Internet. However, neither the devices nor the wireless networks they require are readily available in developing countries as yet. The small screen size of smart phones and PDAs also offer a challenge, as does the low bandwidth of most mobile networks. Web pages must be reformatted for small devices and low-bandwidth transmission (Chandler, 2008; Elder & Clarke, 2009).

Multimedia

Emerging audio-visual technologies can help health programs reach audiences that have low literacy (Chetley 2006; West, 2008). Speech interface technologies, including text-to-speech and speech recognition, can power voice-based information systems like the ones described above for mobile phones. Portable digital video technologies permit individuals to produce and screen local language videos easily and inexpensively. Together with the cameras that are increasingly found on mobile phone handsets, these simple video technologies can capture project activities and tell stories in more compelling ways. Health organizations can use Web sites like YouTube and Flickr to share these kinds of photos and videos with a wide audience. They can also use podcasting to distribute audio and video recordings inexpensively over the Web, allowing people to listen whenever they choose (ICT-KM, 2008). While the HIPNET interviews found great interest in multimedia technologies, especially video, FP/RH organizations are still trying to figure out how best to exploit them.

Web 2.0

The term Web 2.0 refers to a second generation of Web development, design, and tools that is changing how information is created and transmitted over the Internet. Generally speaking, Web 2.0 tools and technologies encourage collaboration, interactivity, and knowledge sharing. The tools are so new that there is no agreement on best practices, and only anecdotal assessments of impact are available. Experience suggests, however, that they can promote internal as well as external collaboration and knowledge sharing. For example, businesses have used Web 2.0 tools both to:

- Promote internal collaboration and capture unstructured knowledge from employees; and
- Strengthen connections and promote dialogue with suppliers, partners, and customers (Bughin & Manyika, 2007).

HIPNET interviews confirmed observations in the business community, which describe a generational divide in experience, attitudes, opinions, and enthusiasm regarding Web 2.0 tools. Older members of an organization tend not to understand or appreciate the opportunities offered by Web 2.0 tools, they take a cautious approach towards experimenting with them, and they may actively hinder their adoption. As a result, grassroots efforts may be more successful than top-down initiatives in introducing Web 2.0 tools. Since the tools are simple to implement, small groups of interested (typically younger) employees can launch informal pilots to test their viability. This approach benefits from the passion and knowledge that “natural owners” can bring to bear on an issue (Bughin & Manyika, 2007).

The following are some of the Web 2.0 tools that hold the most promise for the health and development sectors:

- **Web logs (blogs):** Are online journals that allow organizations to informally share project updates, reflect on progress, and engage with the community. Over time, a blog can create a “learn as we go” record of a project. Alternatively, leaders may use blogs to share ideas, reflect, and pose questions and concerns to their staff (ICT-KM, 2009). A blog produced by the INFO Project proved to be a success on several fronts: It gave the project a personalized voice, helped engage collaborators and “customers” by demonstrating staff members’ commitment to the issues they worked on, and stimulated conversation within INFO among people working on different activities (Reiss, 2009, personal communication). However, some health information organizations question whether blogs are appropriate for official Web sites. They worry that the content of blogs may not be sufficiently vetted and, as a result, may create accuracy issues or distort the organization’s message.

- **Micro-blogging:** Are tools such as Twitter that permit users to send brief text updates to individuals, a selected group, or the world at large via cell phones, email, MP3 players, or the Web. They may be especially well-suited because they can take advantage of the heavy reliance on mobile phones (Mumba, 2007). Organizations may use microblogging to announce activities and publications, while individuals can exchange information and questions with a network of people with common interests and concerns (ICT-KM, 2009). Forum One Communications uses a private microblogging tool called Socialcast to promote internal knowledge sharing. Socialcast lets staff members exchange information informally, for example, by asking and answering quick questions. Perhaps because of microblogging's informality—and/or its “cool” factor—the tool seems to be more effective than email at certain kinds of internal knowledge sharing (Pringle, 2009).
- **Wikis:** Are simple online databases that allow any user with a Web browser to easily edit each page; wikis also keep track of the history of each page so that users can track changes and examine the evolution of contributors' thought processes. They have become a popular and effective tool for workgroups in the health and development sectors, which use them as a collaborative workspace for documents and projects. Wikis also allow groups to manage content that changes over time, such as process manuals and FAQs (ICT-KM, 2009). The Knowledge Management for Development (KM4Dev) community uses its wiki (http://www.km4dev.org/wiki/index.php/Main_Page) in part to share the community's perceptions of the state-of-the-art in knowledge management and knowledge sharing with a wider audience. The Community Knowledge area of the wiki makes FAQs and information pages out of the knowledge that surfaces in the community's online conversations and from member experiences.
- **Social bookmarking:** Allows individuals to save bookmarks to a public Web site and “tag” them with keywords. If a Community of Practice (CoP) agrees to tag useful Web resources with a shared tag, members can benefit from each other's searches. For example, members of the KM4Dev community began bookmarking resources they wanted to collect and share with a single tag (“npk4dev”) at the social bookmarking site, del.icio.us. Their efforts have built a public, searchable set of online resources—including websites, wikis, and blogs—of interesting content on knowledge management for development (<http://npk4dev.wordpress.com/>).
- **Social-networking sites:** Are sites like Facebook that build online communities with shared interests and activities and provide various ways for them to interact, including messaging, email, video, voice chat, file sharing, blogging, and discussion groups. Recent years have seen enormous growth in the number of people using social networking sites in low- and middle-income countries (see Table 1) and the amount of time they are spending there. Social networking now accounts for one in every four minutes that Internet users in Brazil spend online (Nielson Company, 2009).

Table 1. Growth in worldwide audience (age 15+) for social-networking sites, including access at home and at work

Region	Number of unique visitors		Percent change
	June 2007	June 2008	
Asia - Pacific	162,738,000	200,555,000	23%
Europe	122,527,000	165,256,000	35%
North America	120,848,000	131,255,000	9%
Latin America	40,098,000	53,248,000	33%
Middle East & Africa	18,226,000	30,197,000	66%
<i>Worldwide</i>	<i>464,437,000</i>	<i>580,510,000</i>	<i>25%</i>

Source: comScore World Metrix (comScore Inc., 2008)

Commercial social-networking sites potentially can offer health and development organizations a new platform for knowledge sharing that enjoys broad reach and encourages interactivity. For example, MEASURE DHS is launching a Facebook page to reach new and different audiences for data from Demographic and Health Surveys (DHS). The organization hopes Facebook will provide a more interactive way to stay in touch with people, will drive people to the DHS Web site, and will collect the kind of in-country success stories that elude formal surveys. However, critics note that health and development organizations often launch Facebook pages without a strategy to draw an audience or benefit from the site. The HIPNET interviews suggested that a different and perhaps more productive way to view commercial social-networking sites is not as a platform, but rather as an inspiration and role model for the design of an organization's own knowledge networks.

ICT Applications for Health

The health sector has experimented with a wide variety of ICTs, ranging from radios and telephones to videoconferencing and the Internet, to reach different audiences, including policymakers, managers, frontline providers, patients, and the general public (see Table 2). Of the many projects piloted, only some have been scaled up and institutionalized. Nevertheless, they suggest the potential uses of computer-based ICTs, mobile devices, and other technologies for knowledge sharing in the health sector. Four e-health functions of special relevance to frontline providers and program managers are discussed here: professional development, support for patient care, networking, and access to the scientific literature.

Table 2. E-health functions using ICTs

Audiences	Functions	Technologies Tested
Policymakers and managers	Disease surveillance Data collection HMIS systems	Mobile phones and PDAs Computers
Providers and managers	Professional development Support for patient care Teleconsultations Networking Access to the scientific literature	CD-ROMs Mobile phones and PDAs Email Internet Radio Videoconferencing
Patients	Monitoring and reminders	Mobile phones Remote sensors
General public	Health education and promotion	Mobile phones Internet

Professional development

As ICTs diffuse globally, they create new opportunities to meet health workers' needs for preservice and continuing education. They are especially useful for nurses, doctors, and community health workers who work in remote areas and cannot easily attend traditional training venues. The key is to choose the most appropriate technology for the setting, since it is possible to accomplish the same ends with different technologies. For example, the eLearning for Health project in the Philippines was able to connect community health volunteers with an expert in Manila for live question-and-answer sessions via broadband Internet, videoconferencing, or mobile phones. Voice calls proved the most effective (Marcelo, 2009). Projects can also design platforms with technological limitations in mind. For example, the Réseau Afrique Francophone de Télémédecine (RAFT) project relies on the Internet to host and distribute large numbers of courses to create a systematic educational system. To make the system viable in sub-Saharan Africa, RAFT developed an online instructional platform that requires minimal bandwidth to transmit high quality voice and still images. It also lets users adjust the quality of video downward as needed (Geissbuhler et al., 2007).

Productive and tested approaches to professional development include:

- Broadcasting distance education serials for providers over the radio;
- Building mobile phone platforms that allow students to send questions and comments to fellow students and teachers via SMS or voice messages;
- Loading eLearning materials on PDAs;
- Distributing interactive training courses on CD-ROM to avoid problems created by limited Internet bandwidth;
- Hosting classes on the Internet, ranging from individual Webinars to comprehensive programs of coursework; and
- Sponsoring email and online forums that share high-quality information with participants and provide a venue for discussion and resource-sharing.

Support for patient care

Health care providers need access to up-to-date and practical information on patient care. To meet this need, some initiatives have created online databases of carefully screened and selected materials. For example, the Internet portal AfroAIDSinfo (www.afroaidsinfo.org) provides up-to-date, scientifically accurate information on HIV/AIDS with a specific focus on the Southern African region.

Physicians in industrialized countries have long had a wide choice of commercial software products for PDAs that supply diagnostic and treatment tools, such as drug dosage calculators and clinical protocols, which can be used during consultations (UN, 2007). Pilot projects in some countries have started creating similar products that convey locally relevant information, such as district guidelines or alerts about local disease outbreaks; focus on patient populations of special interest, such as people living with HIV/AIDS or pregnant women; and meet the needs of frontline providers, such as nurses and community-based health workers.

Tele-consultation systems have been widely deployed in low- and middle-income countries as a way to leverage the expertise of medical specialists who are in short supply. They allow frontline providers to contact tertiary facilities for advice on how to treat a patient. The systems use a wide variety of ICTs, ranging from voice calls and SMS messages, to email messages with photos attached, to sophisticated medical testing systems (Malakata, 2007).

Networking

ICTs can help health professionals at all levels share their knowledge and experience when time and distance does not permit them to meet face-to-face. Email listservs and discussion forums are among the most ubiquitous tools used for networking: they are affordable, asynchronous, and open to anyone with an email account, anywhere on earth. They can link colleagues in remote locations and across time zones, amplify the voice of people in remote locations, and facilitate communication and the generation of new knowledge. Compared with email, Web-conferencing and videoconferencing require greater technological investments, but they can support live events with real-time debate and dialogue between participants located in different countries (Solez et al., 2005).

CoPs represent the ultimate in virtual networking because they bring people with similar interests and similar job functions together in an ongoing community. Membership in a CoP allows people to overcome professional isolation and connect with peers and colleagues, no matter where they are located. Members can ask questions, find help, keep up-to-date with current knowledge and best practices, and validate their own practices (Hara & Hew, 2006). By tapping the expertise and experience of the entire group, CoPs can also reach consensus on emerging practices and policies and generate new knowledge. CoPs typically use both email and Internet technologies to communicate. They may operate listservs, hold periodic discussion forums, publish digests and newsletters, sponsor online discussion boards, maintain archives and libraries of relevant documents, post announcements of events and job openings, and more (Hardon, 2005). Some FP/RH organizations have also found internal CoPs extremely useful to promote communication among staff members.

Broader knowledge networks promote communication and knowledge sharing among a wider audience of policy makers, researchers, program managers, providers, and even the general public. Many of these networks exist in the health and development arena, and some focus on a specific health issue. For example, the Implementing Best Practices (IBP) Knowledge Gateway works in reproductive health, while the Health & Development Networks (HDN) addresses HIV/AIDS issues. Others, such as the Health Action Information Network (HAIn) in the Philippines, focus on a geographical region or country. Still others focus on the use of ICTs for health and development, such as Knowledge for Development (K4D) and the Zunia Knowledge Exchange.

It is difficult to draw frontline managers and providers into electronically-based networks in some countries, because they do not have reliable access to the Internet. They are far more likely to participate in networks that operate on a face-to-face basis, such as professional groups representing nurses and doctors, health taskforces, and local workgroups.

Access to the literature

It can be difficult for researchers and academics, as well as decision-makers and managers to access the scientific literature and/or contribute to scientific discourse (Bukachi & Pakenham-Walsh, 2007; Horton, 2000). International organizations and public-private partnerships have experimented with a wide variety of approaches to improve access to the scientific literature, to encourage the publication of studies conducted by researchers, and to promote the dissemination of locally relevant information. These initiatives include:

- Free online databases of citations, abstracts, and full text articles;
- Open access journals that publish online and do not charge readers subscription or access fees;
- National and regional journals that publish information of local relevance;
- Databases and indexes of medical and public health literature published in specific regions, with the expressed objective of increasing access to the scientific and medical literature published in those regions;
- Mini-libraries that contain small collections of essential print materials for use by district hospitals and other frontline facilities;
- Libraries on CD-ROM that include health education and training materials, scientific literature, and entire databases; and
- On-site digital libraries loaded on a computer server, which can be installed as part of a local computer network.

Implications and Recommendations

Appropriate technologies and tools

With the advent of new technologies involving computers, the Internet, and mobile devices, the number of potential communication channels is growing quickly. This makes it more challenging for health information programs to select the communication technologies and tools that will be the most effective in sharing knowledge with a specific audience. Key factors include a technology's reach, costs, human capacity requirements, and ease of use.

Older tactics, such as face-to-face meetings, print, radio, and CD-ROMs, may not be as exciting as electronic forms of communication, but they have far greater reach and sustainability in many settings, including the rural areas where most service delivery takes place. Experts in the field acknowledge that face-to-face interaction is irreplaceable, that there is a strong preference for print within some settings, and that CD-ROMs can sidestep bandwidth limitations that inhibit Web-based distribution systems. Given how limited, slow, and unreliable Internet connectivity is in many parts of the world, migrating too quickly from older technologies to total reliance on the Web will leave parts of the audience behind.

However, new technologies can be extremely cost-effective, for example, the cost-benefit of posting a PDF file online instead of paying to ship thousands of hard copies long distances is clear. When working with Internet-based tools and technologies, it is important to anticipate and address bandwidth issues, for example, by designing platforms with low bandwidth options and minimizing the size of downloadable files. Health information programs also need to appreciate the dominance of email over Web browsing in some countries, along with the critical role of local partners on the ground to move information the last mile—off the Web and into the hands of program managers and providers.

Health information programs should consider exploring several promising trends:

- SMS, voice, and Web applications for mobile phones and other devices;
- Inexpensive camera and video technologies;
- The use of community access points and local intermediaries to extend the reach of the Internet and promote a program's presence online; and
- Social networking and other Web 2.0 tools.

Meeting the need for locally relevant content

A strong, consistent, and repeated message from the field is that information for health workers is useless unless it is tailored to the local setting and to the educational level and information needs of a specific cadre of health workers. However, it is difficult, labor-intensive, and costly to repackage information in this way. Translation into local languages, while essential, can be especially burdensome. Health information programs should consider sharing the task:

- With local librarians and information specialists, who possess knowledge management skills and understand the local setting and audiences;
- With local information users, that is, government agencies, NGOs, academics, and health professionals in the country; and
- Among countries that have similar information needs, settings, and languages.

Web-based collaboration tools, such as wikis and Web-conferencing, can facilitate these types of working relationships.

Needs assessments, monitoring, and evaluation

Health information needs assessments should explore both the perceived and actual information needs of providers. That means asking three questions: What kinds of information do providers say they need and want? When asked about essential health information, which questions do providers answer incorrectly? What do providers do wrong during the course of their work?

Based on the answers to these questions, programs can simultaneously use “pull” and “push” approaches to disseminate information. On the one hand, they can and should respond to the expressed needs of the audience by supplying them with the information they want (the “pull” model). On the other, they have an obligation to distribute information that is essential to the effectiveness and quality of care but may not be recognized as such by the audience (the “push” model).

Monitoring and evaluation also requires planning and resources. Knowing how many viewers a Web site attracts or how many copies of a publication are downloaded does not offer sufficient guidance to refine and improve information products and services. It is also important to know who is using a material or service and for what purpose, how useful they found it, and what changes could improve it.

References

- Bridges (2003). Evaluation of the SATELLIFE PDA Project, 2002: Testing the use of handheld computers for healthcare in Ghana, Uganda, and Kenya. Cape Town, South Africa: Bridges.org.
- British Telecommunications (2007). Communications technology bridges the digital divide in India. Case Study: LifeLines. London: British Telecommunications.
- Bughin, J., & Manyika, J. (2007). How businesses are using Web 2.0: A McKinsey global survey. The McKinsey Quarterly, McKinsey & Company.
- Bukachi, F., & Pakenham-Walsh, N. (2007). Information technology for health in developing countries. *CHEST*, 132, 1624-1630.
- Caspary, G., & O'Connor, D. (2003). Providing low-cost information technology access to rural communities in developing countries: What works? What pays? Globalising technologies and domestic entrepreneurship in developing countries. OECD Development Centre.
- Chandrasekhar, C., & Ghosh, J. (2001). Information and communication technologies and health in low income countries: the potential and the constraints. *Bulletin of the World Health Organization*, 79(9), 850-855.
- Chandler, C. (2008). The role of hand-held computers (PDAs). Healthcare Information for All by 2015.
- Chetley, A. (2006). Improving health, connecting people: the role of ICTs in the health sector of developing countries. infoDev.
- Colle, R.D. (2003). Increasing the relevance of ICT for development. In: *The Digital Pulse*. Eds. W. Feek & G. Long. Victoria, British Columbia: *The Communication Initiative*, 70-71.
- comScore, Inc. (2008, Aug 12). Social networking explodes worldwide as sites increase their focus on cultural relevance. Reston, VA: comScore, Inc. Retrieved from www.comscore.com/press/release.asp?press=2396.
- Edejer, T. (2000). Disseminating health information in developing countries: The role of the Internet. *British Medical Journal*, 321, 797-800.
- Elder, L., & Clarke, M. (2009). Experiences and lessons learnt from telemedicine projects supported by IDRC. In: *Telehealth in the Developing World*. Eds. R. Wootton, N. Patil, R. Scott and K. Ho. London: *Royal Society of Medicine Press*.
- Esteve, G., & Machin, A. (2007). Devices to access Internet in developing countries. Retrieved from www2007.org/workshops/paper_106.pdf.
- Gakuru, M., Winters, K., et al. (2009). Innovative farmer advisory services using ICT. W3C Workshop: Africa perspective on the role of mobile technologies in fostering social development. Maputo, Mozambique.
- Geissbuhler, A., Bagayoko, C., et al. (2007). The RAFT network: 5 years of distance continuing medical education and tele-consultations over the Internet in French-speaking Africa. *International Journal of Medical Informatics*, 76, 351-326.
- Geyoushi, B., Matthews, Z., et al. (2003). Pathways to evidence-based reproductive healthcare in developing countries. *British Journal of Obstetrics and Gynaecology*, 110, 500-507.
- Girard, B. (2003). Radio and the internet: mixing media to bridge the divide. The one to watch - radio, new ICTs and interactivity. Rome: United Nations Food and Agriculture Organization (FAO).
- Godlee, F., Pakenham-Walsh, N., et al. (2004). Can we achieve health information for all by 2015? *Lancet*, 1-6.

- Hara, N., & Hew, K. (2006). Case study of a longstanding online community of practice involving critical care and advanced practice nurses." \ Proceedings of the 39th Hawaii International Conference on System Sciences, 1-10.
- Hardon, A. (2005). Virtual knowledge communities: Lessons learned in making them work. *Knowledge Management for Development Journal* 1(1), 71-78.
- Hoppenbrouwer, J., & Kanyengo, C. (2007). Current access to health information in Zambia: A survey of selected health institutions. *Health Information and Libraries Journal* 24, 246-256.
- Horton, R. (2000). North and South: Bridging the information gap. *Lancet* 355, 2231-2236.
- ICT-KM Program of the Consultative Group on International Agricultural Research (CGIAR). (2009). Knowledge Sharing Toolkit. Retrieved from www.kstoolkit.org.
- International Telecommunication Union (ITU). (2009). Measuring the information society: The ICT Development Index. Geneva: ITU.
- International Telecommunication Union (ITU). (2008). Implementing e-health in developing countries: Guidance and principles. Geneva: ITU, 1-53.
- Internet World Stats. (2009). Usage and population statistics 2009. Retrieved from <http://www.internetworldstats.com>.
- Juech, C. (2006). Accessing health information in developing countries. *Information Outlook* 12(11), 16-20.
- Kapiriri, L., & Bondy, S.J. (2006). Heath practitioners' and health planners' information needs and seeking behavior for decision making in Uganda. *International Journal of Medical Informatics* 75, 714-721.
- Kaplan, W.A. (2006). Can the ubiquitous power of mobile phones be used to improve health outcomes in developing countries? *Globalization and Health* 2(9), 14.
- Ladd, H., McCullough, L., et al. (2008). Decision support for evidence based public health practice and policy development in the global south. Presented at the Making the eHealth Connection conference. Bellagio, Italy: July 13-August 8, 2008.
- Lambat, Z. (2008). Internet access: is it justifiable? Healthcare Information for All 2015: 1-6. Retrieved from www.hifa2015.org/wp-content/uploads/2008/09/hifa2015-summary-internet-access-is-the-expense-justifiable.pdf.
- Malakata, M. (2007). Telemedicine project to improve Zambia's health delivery. iConnect Online. Retrieved from www.icconnect-online.org/Documents/HealthZambia_iConnect-online.pdf.
- Marcelo, A. (2009). Telehealth in the developing world: Perspective from the Philippines. In: *Telehealth in the Developing World*. Eds R. Wootton, N. Patil, R. Scott & K. Ho. London: Royal Society of Medicine Press.
- Masters, K. (2008). Access to and use of the Internet by South African general practitioners. *International Journal of Medical Informatics* 77, 778-786.
- Maxfield, A. (2004). Information and communication technologies for the developing world. Health Communication Insights. Baltimore, MD: Johns Hopkins Bloomberg School of Public Health, Health Communication Partnership.
- Mumba, S. (2007). The potential of Twitter in Africa. Soyapi Mumba's blog. Retrieved from <http://soyapi.blogspot.com/2007/03/potential-of-twitter-in-africa.html>.
- Muula, A., Misiri, H., et al. (2003). What is the access to continued professional education among health workers in Blantyre, Malawi? EQUINET. Malawi: University of Malawi College of Medicine, 1-6.

- Nielsen Company (2009). Global faces and networked places. New York, New York: The Nielsen Company.
- Oyadoke, A. A., Salami, K. K., et al. (2005-2006). Planning health education: Internet and computer resources in southwestern Nigeria. *International Quarterly of Community Health Education* 25(1-2), 169-83.
- Pakenham-Walsh, N.M., & Bukachi, F. (2009). "Information needs of health care workers in developing countries: a literature review with a focus on Africa." *Human Resources for Health* 7(30).
- Pandita, N., & Singh, S. (2008). Barriers to equitable access to quality health information with emphasis on developing countries. Presented at the Making the eHealth Connection conference. Bellagio, Italy: July 13-August 8, 2008.
- Pringle, J. (April 10, 2009). Cool Tools for International Development Recap & Screencast. SID Development Information Workgroup. Retrieved from <http://siddevinfo.ning.com/profiles/blogs/cool-tools-for-international>.
- Revere, D., Turner, A. M., et al. (2007). Understanding the information needs of public health practitioners: a literature review to inform design of an interactive digital knowledge management system. *Journal of Biomedical Informatics* 40, 410-421.
- Roberts, L.R., Missen, C., et al. (2007). Casting a wider net: improving access to medical literature in developing countries. *Mayo Clinic Proceedings* 82(7), 846-848.
- Roberts, S. (2008). The global information society: A statistical view (partnership on measuring ICT for development). Santiago, Chile: United Nations, 157.
- Satellife (2005). Handhelds for health. Watertown, MA: Satellife.
- Sherwani, J., Mizra, S., et al. (2007). HealthLine: Speech-based access to health information by low-literate users. Proceedings of the IEEE/ACM International Conference on Information and Communication Technologies and Development. Bangalore, India.
- Smith, H., Bukirwa, H., et al. (2007). Access to electronic health knowledge in five countries in Africa: A descriptive study." *BMC Health Services Research* 7, 72.
- Solez, K., Hales, M., et al. (2005). Electronic strategies for information and research: cyberNephrology/cyberMedicine in the emerging world. *Kidney International* 68(Supplement 98), S89-S94.
- Tomasi, E., Facchini, L., et al. (2009). Information technology for primary healthcare in Brazil. In: *Telehealth in the Developing World*. Eds R. Wootton, N. Patil, R. Scott & K. Ho. London: Royal Society of Medicine Press.
- United Nations, Department of Economic and Social Affairs (2007). Mobile applications on health and learning. New York, New York.
- Vital-Wave Consulting (2009). mHealth for development: The opportunity of mobile technology for healthcare in the developing world. Washington, D.C. & Berkshire, UK: UN Foundation-Vodafone Foundation Partnership.
- West, J. (2008). The promise of ubiquity: Mobile media platform in the global south. Paris: Internews Europe.